

## WHAT IS CLAIMED IS:

- 1. A primer selected from the group of:
- 5' TGC TTA ATC AGT GAG GCA CC 3' (SEQ ID'NO:1);
- 5' AGA TCA GTT GGG TGC ACG AG 3' (SEQ ID NO:2);
- 5' CTT GGT CTG ACA GTT ACC 3' (SEQ ID NO:3);
- 5' TGT CGC CCT TAT TCC 3' (SEØ ID NO:4); and
- 5' TCG GGG AAA TGT GCG 3' (SEQ ID NO:5).
- 2. A primer selected from the group of:
- 10 5' ATC GTC CAC CAT CCA CTG CA 3' (SEQ ID NO:6);
  - 5' GGG AAA CGG AAC TGA ATG AG 3' (SEQ ID NO:7);
  - 5' TAG TGG ATC TTT CGC TCC AG 3' (SEQ ID NO:8);
  - 5' GCT CTG CTT TGT TAT TC 3' (SEQ ID NO:9);
  - 5' CAØ TCA AGG ATG TAT TGT G 3' (SEQ ID NO:10); and
- 15 5' TTA GCG TTG CCA GTG CTC G 3' (SEQ ID NO:11).
  - 3. A primer selected from the group of:
  - 5' GGA ACA GÀC TGG GCT TTC ATC 3' (SEQ ID NO:12);
  - 5' GGA CAT CCC CTT GAC 3' (SEQ ID NO:13);
- 20 5' GTG GAT TCA CTT CTG CCA CG 3' (SEQ ID NO:14);
  - 5' CTT CTG GCA TGC CCT ATG AG 3' (SEQ ID NO:15);
  - 5' CAT GAC CCA GTT CGC CAT ATC CTG 3' (SEQ ID NO:16);



- 5' CGA ACG AAT CAT TCA GCA CCG 3' (SEQ ID NO:44); and
- 5' CGG CAA TG/T TTT ACT GTA GCG CC 3' (SEQ ID NO:45).

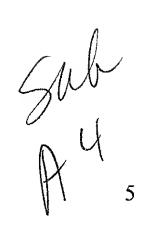
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4. A primer selected from the group of:

- 5' CTG GCA ACC ACA ATG GAC TCC G 3' (SEQ ID NO:18); and
- 5' GCC AGT TCA GCA TCT CCC AGC C 3' (SEQ ID NO:19).
- 5. A primer selected from the group of:
- 10 5' CGT GAC CAA CAA CGC CCA GC 3' (SEQ ID NO:20); and
  - 5' CCA GAT AGC GAA TCA GAT CGC 3' (SEQ ID NO:21).
  - 6. A primer selected from the group of:
  - 5' CCA GCC GAT GCT CAA GGA G 3' (SEQ ID NO:22); and
- 15 5' CAC GAA CGC CÁC ÁTA GGC G 3' (SEQ ID NO:23).
  - 7. A primer selected from the group of:
    - 5' GGC ATT GGG ATA GTT GCG GTT G 3' (SEQ ID NO:24); and
  - 5' TTA CTA CAA GGT CGG CGA CAT GAC C 3' (SEQ ID NO:25).

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- 8. A primer selected from the group of:
- 5' GGA TCA CAC/TAT TAC ATC TCG C 3' (SEQ ID NO:26); and
- 5' CGT ATØ GTT GAG TTT GAG TGG C 3' (SEQ ID NO:27).



- 9. A primer selected from the group of:
- 5' GCG ACC TGG TTA ACT ACA ATC CC 3' (SEQ ID NO:28); and
- 5' CGG TAG TAT TGC CC TTA AGC C 3' (SEQ ID NO:29).
- 10. A primer selected from the group of:
- 5' CGG AAA AGC ACG TCG/ATG GG 3' (SEQ ID NO:30); and
- 5' GCG ATA TCG TTG GTG GTG CC 3' (SEQ ID NO:31).
- 11. A primer selected from the group of:
- 10 5' CTC GAT GAT GCG TGC TTC GC 3' (SEQ ID NO:32); and
  - 5' GCG/ACT GTG ATG TAT AAA CG 3' (SEQ ID NO:33).
  - 12. A primer selected from the group of:
  - 5' CGT CGC TCA CCA TAT CTC CC 3' (SEQ ID NO:34); and
- 15 5' CCT CTC GTG CTT TAG ACC CG 3' (SEQ ID NO:35).
  - 13. A primer selected from the group of:
    - 5' CGC TGG GAA ACC TAT TCG G 3' (SEQ ID NO:36); and
  - 5' CTG CCA TCC AGT TTC TTC GGG 3' (SEQ ID NO:37).
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- 14. A primer selected from the group of:
- 5' GGT GGC ATT GAC AAA TTC TGG 3' (SEQ ID NO:38); and
- 5' CCC ACC ATG CGA CAC CAG 3' (SEQ ID NO:39).

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- 15. A primer selected from the group of:
- 5' TGT GCA ACG CAA ATG GCA C 3' (SEQ ID NO:40); and
- 5' CGA CCC CAA GTT TCC TGT AAG TG 3' (SEQ ID NO:41).
- 5 16. A primer selected from the group of:
  - 5' AGG CAC GAT AGT TGT GGC AGA C 3' (SEQ ID NO:42); and
  - 5' CAC TCA ACC CAT CCT ACC CAC C 3' (SEQ ID NO:43).
  - 17. A method for identifying a beta-lactamase in a clinical sample, the method comprising:

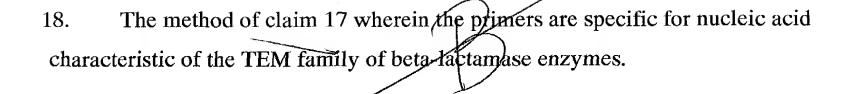
providing a pair of oligonucleotide primers, wherein one primer of the pair is complementary to at least a portion of the beta-lactamase nucleic acid in the sense strand and the other primer of each pair is complementary to at least a portion of the beta-lactamase nucleic acid in the antisense strand;

annealing the primers to the beta-lactamase nucleic acid;

simultaneously extending the annealed primers from a 3' terminus of each primer to synthesize an extension product that is complementary to the nucleic acid strands annealed to each primer wherein each extension product after separation from the beta-lactamase nucleic acid serves as a template for the synthesis of an extension product for the other-primer of each pair;

separating the amplified products; and

analyzing the separated amplified products for a region characteristic of the betalactamase.



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- 19. The method of claim 18 wherein the primers are selected from the group of:
- 5' TGC TTA ATC AGT GAG GCA CC 3' (SEQ ID NO:1);
- 5' AGA TCA GTT GGG TGC ACG AG 3' (SEQ ID NO:2);
- 5' CTT GGT CTG ACA GTT ACC 3' (SEQ ID NO:3);
- 5' TGT CGC CCT TAT TCC 3' (SEQ ID NO:4); and
- 5' TCØ GGG AAA TGT GCG 3' (SEQ ID NO:5).

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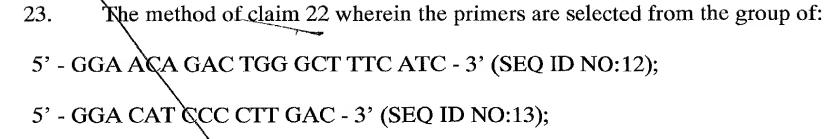
20. The method of claim 17 wherein the primers are specific for nucleic acid characteristic of the SHV family of beta-lactamase enzymes.

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- 21. The method of claim 20 wherein the primers are selected from the group of:
- 5' ATC GTC CAC CAT CCA CTG CA 3' (SEQ ID NO:6);
- 5' GGG AAA CGG AAC TGA ATG AG-3' (SEQ ID NO:7);
- 5' TAG TGG ATC TTT CGC/TCC AG 3' (SEQ ID NO:8);
- 5' GCT CTG CTT PGT TAT TC 3' (SEQ ID NO:9);
- 5' CAC TeA AGG ATG TAT TGT G 3' (SEQ ID NO:10); and
- 20 5' TTA GCG TTG CCA GTG CTC G 3' (SEQ ID NO:11).
  - 22. The method of claim 17 wherein the primers are specific for nucleic acid characteristic of the AmpC beta-lactamase enzyme found in *Enterobacter cloacae*.

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5' - CTT CTG GCA TGC CCT ATG AG - 3' (SEQ ID NO:15);

5' - GTG GAT TCACTT CTG CCA CG - 3' (SEQ ID NO:14);

5' - CAT GAC CCA GTT CGC CAT ATC CTG - 3' (SEQ ID NO:16); and

5' - ATT CGT ATG CTG GAT CTC GCC ACC - 3' (SEQ ID NO:17).

5' - CGA ACG AAT CAT TCA GCA CCG - 3' (SEQ ID NO:44); and

5' – CGG CAA TGT TTT ACT GTA GCG CC - 3' (SEQ ID NO:45).

24. The method of claim 17 wherein the primers are specific for nucleic acid characteristic of the AmpC beta-lactamase enzyme found in *Citrobacter freundii*.

25. The method of claim 24 wherein the primers are selected from the group of:

5' - CTG GCA ACC ACA ATG GAC TCC G - 3' (SEQ ID NO:18); and

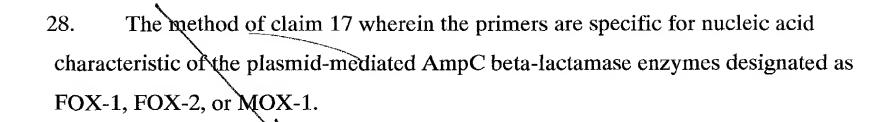
5' - GCC AGT TCA GCA TCT CCC AGC C - 3' (SEQ ID NO:19).

26. The method of claim 17 wherein the primers are specific for nucleic acid characteristic of the AmpC beta-lactamase enzyme found in Serratia marcescens.

27. The method of claim 26 wherein the primers are selected from the group of:

5' - CGT GAC CAA CAA CGC CCA GC - 3' (SEQ ID NO:20); and

5' - CCA GAT AGC GAA TCA GAT CGC - 3' (SEQ ID NO:21).



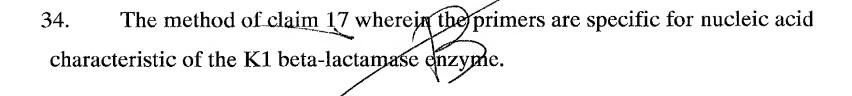
- 5 29. The method of claim 28 wherein the primers are selected from the group of:
  - 5' CCA GCC GAT GCT CAA OGA G 3' (SEQ ID NO:22); and
  - 5' CAC GAA CGC CAC ATA GGC G 3' (SEQ ID NO:23).
- 30. The method of claim 17 wherein the primers are specific for nucleic acid characteristic of the AmpC beta-lactamase enzyme found in *Pseudomonas aeruginosa*.

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- 31. The method of claim 30 wherein the primers are selected from the group of:
- 5' GGC ATT GGG ATA GTT GCG GTT G 3' (SEQ ID NO:24); and
- 5' TTA CTA CAA GGT CGG CGA CAT GAC C 3' (SEQ ID NO:25).
- 32. The method of claim 17 wherein the primers are specific for nucleic acid characteristic of the AmpC beta-lactamase enzyme found in *E. coli*.

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- 33. The method of claim 32 wherein the primers are selected from the group of:
- 5' GGA TCA CAC TAT TAC ATC TCG C 3' (SEQ ID NO:26); and
- 5' CGT ATG GTT GAG TTT GAG TGG C 3' (SEQ ID NO:27).



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- 35. The method of claim 34 wherein the primers are selected from the group of:
- 5' GCG ACC TGG TTA ACT ACA ATC CC 3' (SEQ ID NO:28); and
- 5' CGG TAG TAT TGC CC TTA AGC C 3' (SEQ ID NO:29).
- 36. The method of claim 34 wherein the primers are selected from the group of:
- 5' CGG AAA AGC ACG TCG ATG GG 3' (SEQ ID NO:30); and
- 5' GCG ATA TCG TTG GTG GTG CC 3' (SEQ ID NO:31).
  - 37. The method of claim 17 wherein the primers are specific for nucleic acid characteristic of the PSE1, PSE4, and CARB3 beta-lactamase enzymes.
  - 38. The method of claim 37 wherein the primers are selected from the group of:
  - 5' CTC GAT GAT GCG TGC TTC GC 3' (SEQ ID NO:32); and
  - 5' GCG ACT GTG ATG TAT AAA CG 3' (SEQ ID NO:33).
  - 39. The method of claim 17 wherein the primers are specific for nucleic acid characteristic of the OXA-9 beta-lactamase enzyme.
  - 40. The method of claim 39 wherein the primers are selected from the group of:
  - 5' CGT CGC TCA CCA TAT CTC CC 3' (SEQ ID NO:34); and
  - 5' CCT CTC GTG CTT TAG ACC CG 3' (SEQ ID NO:35).

- 41. The method of claim 17 wherein the primers are specific for nucleic acid characteristic of the OXA-12 beta-lactamase enzyme.
- 42. The method of claim 41 wherein the primers are selected from the group of:
- 5' CGC TGG GAA ACC TAT TCG G 3' (SEQ ID NO:36); and
  - 5' CTG CCA TCC AGT TTC TTC GGG 3' (SEQ ID NO:37).
  - 43. The method of claim 17 wherein the primers are specific for nucleic acid characteristic of the OXA-5, 6, 7, 10, 11, 13, and 14 beta-lactamase enzymes.

- 44. The method of claim \( \)43 wherein the primers are selected from the group of:
- 5' GGT GGC ATT GAC AAA TTC TGG 3' (SEQ ID NO:38); and
- 5' CCC ACC ATG CGA CAC CAG 3' (SEQ ID NO:39).
- 15 45. The method of claim 17 wherein the primers are specific for nucleic acid characteristic of the OXA-1 beta-lactamase enzyme.
  - 46. The method of claim 45 wherein the primers are selected from the group of:
  - 5' TGT GCA ACG CAA ATG GCA C 3' (SEQ ID NO:40); and
- 5' CGA CCC CAA GTT TCC TGT AAG TG -\3' (SEQ ID NO:41).
  - 47. The method-of-claim 17 wherein the primers are specific for nucleic acid characteristic of the OXA-2, 3, and 15 beta-lactamase enzymes.



- 48. The method of claim 47 wherein the primers are selected from the group of:
- 5' AGG CAC GAT AGT TGT GGC AGA C 3' (SEQ ID NO:42); and
- 5' CAC TCA ACC CAT CCT ACC CAC C 3' (SEQ ID NO:43).
- 49. A diagnostic kit for detecting a TEM family beta-lactamase which comprises packaging, containing, separately packaged:
- (a) at least one primer pair capable of hybridizing to beta-lactamase nucleic acid of interest;
- (b) a positive and negative control; and
- (c) a protocol for identification of the beta-lactamase nucleic acid of interest.
  - 50. The diagnostic kit of claim 49 wherein the primers are selected from the group of:
  - 5' TGC TTA ATC AGT GAG GCA CC 3' (SEQ ID NO:1);
- 15 5' AGA TCA GTT GGG TGC ACG AG 3' (SEQ ID NO:2);
  - 5' CTT GGT CTG ACA GTT ACC 3' (SEQ ID NO:3);
  - 5' TGT CGC CCT TAT TCC 3' (SEQ ID NO:4); and
  - 5' / TCG GGG AAA TGT GCG 3' (SEQ ID NO:5).

- 51. A diagnostic kit for detecting a SHV family beta-lactamase which comprises packaging, containing, separately packaged:
- (a) at least one primer pair capable of hybridizing to beta-lactamase nucleic acid of interest wherein at least one of the primers is selected from the primers of claim 2;
  - (b) a positive and negative control; and
  - (c) a protocol for identification of the beta-lactamase nucleic acid of interest.
- 52. A diagnostic kit for detecting an AmpC family beta-lactamase which comprises packaging, containing, separately packaged:
  - (a) at least one primer pair capable of hybridizing to beta-lactamase nucleic acid of interest;
    - (b) a positive and negative control; and
  - (c) a protocol for identification of the beta-lactamase nucleic acid of interest.
    - 53. The kit of claim 52 wherein at least one of the primers is selected from the group consisting of:
    - 5' CTG GCA ACC ACA ATG GAC TCC G 3' (SEQ ID NO:18);
- 20 5' GCC AGT TCA GCA TCT CCC AGC C 3' (SEQ ID NO:19);
  - 5' CGT GAC CAA CAA CGC CCA GC 3' (SEQ ID NO:20);
  - 5' CCA GAT AGC GAA TCA GAT CGC 3' (SEQ ID NO:21);
  - 5' GGC ATT GGG ATA GTT GCG GTT G 3' (SEQ ID NO:24);
  - 5' TTA CTA CAA GGT CGG CGA CAT GAC C 3' (SEQ ID NO:25);



- 5' CGT ATG GTT GAG TTT GAG TGG C 3' (SEQ ID NO:27); and complements thereof.
- 5 54. A diagnostic kit for detecting a K1 family beta-lactamase which comprises packaging, containing, separately packaged:
  - (a) at least one primer pair capable of hybridizing to beta-lactamase nucleic acid of interest;
    - (b) a positive and negative control; and
- (c) a protocol for identification of the beta-lactamase nucleic acid of interest.
  - 55. The kit of claim 54 wherein at least one of the primers is selected from the group consisting of:
  - 5' GCG ACC TGG TTA ACT ACA ATC CC 3' (SEQ ID NO:28);
- 15 5' CGG TAG TAT TGC CC TTA AGC C 3' (SEQ ID NO:29);
  - 5' CGG AAA AGC ACG TCG ATG GG 3' (SEQ ID NO:30);
  - 5' GCG ATA TCG TTG GTG GTG CC 3' (SEQ ID NO:31); and complements thereof.
- 56. A diagnostic kit for detecting a PSE1, PSE4, or CARB3 family beta-lactamase which comprises packaging, containing, separately packaged:
  - (a) at least one primer pair capable of hybridizing to beta-lactamase nucleic acid of interest;
    - (b) a positive and negative control; and
- (c) a protocol for identification of the beta-lactamase nucleic acid of interest.

- 57. The kit of claim 56 wherein at least one of the primers is selected from the group consisting of:
- 5' CTC GAT GAT GCG TGC TTC GC 3' (SEQ ID NO:32);
- 5' GCG ACT GTG ATG TAT AAA CG 3' (SEQ ID NO:33); and complements thereof.